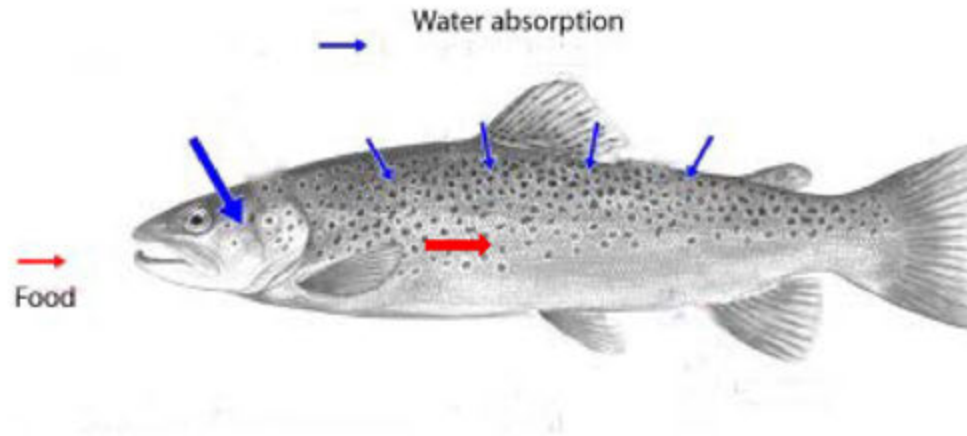


Screening-Level Bioaccumulation Modeling

Principles of Bioaccumulation

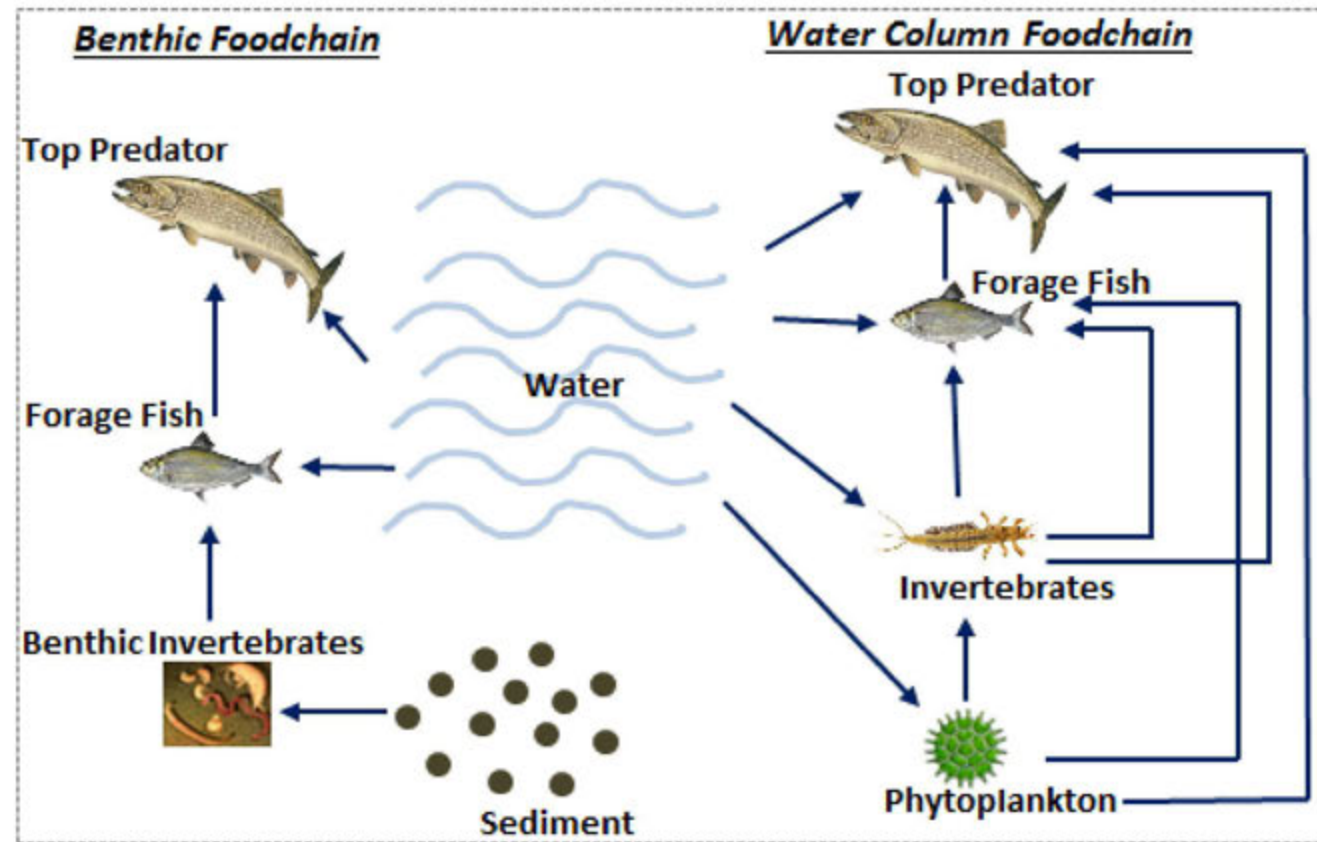
- Fish (and other organisms) obtain PCBs from water and food
 - Directly from the water column via gills and skin
 - From the food that they eat via the gut



Bioaccumulation and Bioaccumulation Modeling: March 9, 2018

Principles of Bioaccumulation

- Food sources are part of a food web, which can vary across fish species

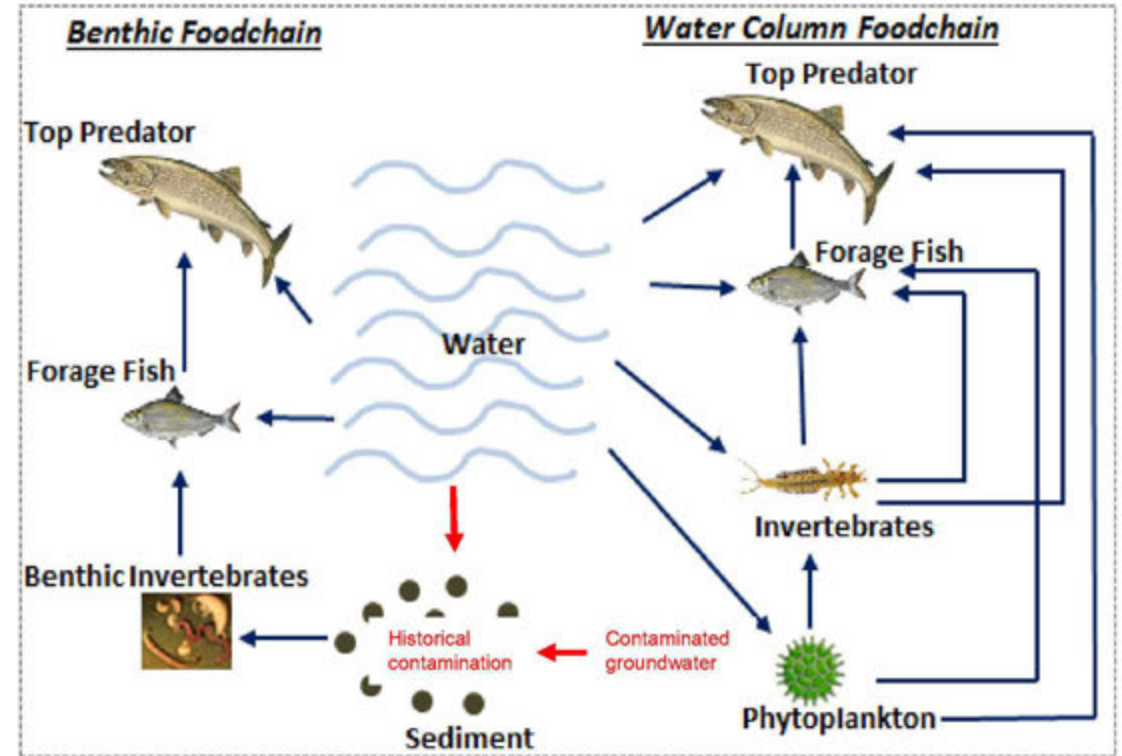


Objective

- Apply tool that calculates expected fish tissue PCB concentrations, based observed upon water column and sediment PCB concentration
- Desired Outcomes
 - Identification of pathways leading to fish contamination
 - A qualitative understanding of whether fish tissue PCB are at expected levels, or whether additional previously un-identified sources are required.

Why We Care about Bioaccumulation in Spokane

- An understanding of the pathways by which Spokane-area fish obtain their PCBs will help focus control efforts
 - Water column pathway: Control PCB sources to water column
 - Sediment pathway: Control sediment PCB sources*



*which may originate from historical or ongoing water column sources, or contaminated groundwater

Approach

- Original plan was to apply two models
 - Serdar et al (2011) application to Spokane
 - “Sediment-based model”
 - Wenatchee River model of Hobbs and Friese (2016)
 - “Biofilm-based model”
- After consultation with Ecology, revised plan was to apply the Wenatchee framework with Spokane-specific inputs

Models Assumptions

- Focus comparisons on Mountain Whitefish
 - Fish species used in the Wenatchee
- Drive model with observed concentrations between Plante's Ferry and Nine Mile
 - Some mixing and matching involved
 - No locations with concurrent measurements of sediment, biofilm, water column, and whitefish
- Compare model results to average whitefish PCB concentrations observed in that section of river in 2012

Models Inputs

- Water column
 - PCB congener distribution, suspended solids, organic carbon, temperature
- Bottom sediments
 - PCB congener distribution, organic carbon
- Biota
 - Observed whitefish weight and lipid content
 - Observed macroinvertebrate lipid content

Model Results

- Results are too uncertain to directly address management-related questions in any detail
 - How important are sediment sources?
 - 7x difference in observed sediment PCBs between two 2018 sites
 - Can “typical” sediment concentrations explain existing fish tissue PCBs?
 - Depends on what food web assumptions are made

Model Results

- Model indicates that sediments play a role in fish tissue contamination
- Large (100x) difference exists in bioaccumulation across congeners
 - Prior observations on water column and fish tissue concentrations are plausible
 - Prevalent congeners in water should not be expected to be the prevalent congeners
 - Elevated fish tissue concentrations can occur for congeners near water column detection limit

